

A Rural Sanitation Program

—Lancaster County, Nebraska—

By LESTER A. SANGER, C.E.

THE DEVELOPMENT of rural sanitation programs has followed at quite a distance the development of sanitation programs in urban and fringe areas of relatively high population density. This is an understandable pattern assuming that the magnitude and importance of environmental sanitation problems are directly proportionate to the population density. However, the isolation of rural villages and farm homes is rapidly fading, and the rural population now contributes measurably to the environmental health problems of a region.

There are many ways to develop a rural sanitation program, and it would be improper to draw any inference that the procedures in Lancaster County, Nebr., are necessarily a model for others to follow. The procedures may, however, contribute to the planning of programs in similar areas.

The prelude to the sanitation program in Lancaster County was the reorganization of the health department.

Community Profile

Lancaster County covers 864 square miles of gently rolling farm land and has 21 small

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towns, 6 of which range in size from 200 to 450 people. Exclusive of the city of Lincoln, with a population of approximately 100,000, the county has a population of about 20,000. The people are of German, Bohemian, Dutch, Russian, Irish, and English descent. There are 80 rural schools and 15 consolidated town schools.

During 1945 and 1946 the Lincoln City Health Department was reorganized to meet the standards of a modern full-time local health unit. This involved the addition of professional public health personnel to the staff and major revisions in the organization and activities of the department.

The civic groups that were instrumental in the modernization of the Lincoln City Health Department, chiefly women's organizations, joined hands with their rural counterparts and began to "beat the drums" for the organization of a combined city-county health unit. They recognized the desirability of extending health services to the fringe areas surrounding Lincoln and, indeed, to the entire county.

Meetings with numerous civic groups and rural organizations were followed by public hearings conducted by the board of county commissioners during the winter of 1946-47. These public meetings were interesting demonstrations of democracy in action. It was conspicuous that the decisive force for the organization of the combined city-county unit came from several women leaders in the community and the organizations they represented. The

Lincoln-Lancaster County Health Department became a reality July 1, 1947.

The Rural Sanitation Program

A preliminary survey of the county revealed that the geographic distribution of environmental sanitation problems could be classified into four main groups:

1. Fringe areas adjacent to Lincoln.
2. Town areas (including the usual problems of food sanitation, private sewage disposal, water supplies, insect and rodent control).
3. Farmstead sanitation (water and sewage).
4. Schools (rural and town).

The Lincoln-Lancaster health department chose to launch the rural sanitation program through the medium of a school sanitation program. It would permit the department to distribute a service uniformly throughout the county. Many sanitary improvements in the school environment were needed, and the county superintendent of schools was not only the respected authority throughout the rural school system, but also he was influential within the family of county officials.

During that first school year, the rural sanitarian made a complete survey of all rural and town schools. The survey consisted of checking on the standard items of school sanitation: water supply, toilet facilities, school lighting, and so forth.

In most schools the survey was conducted as an educational experience for the teacher and children, especially in the one-room rural schools. At every opportunity the sanitarian stressed the importance of a safe school water supply and sewage disposal system, and emphasized that the same applied to their own farm wells and toilet facilities.

Long before the survey of all schools was completed, the health department began receiving requests to talk at Grange and parent-teacher association meetings. These meetings provided the opportunity to introduce the parents to public health in general, to the services we could give for the asking, and, in particular, to specific details of safe farm water supplies and sewage disposal systems. The

meetings followed a somewhat standard form—formal presentation of the material supplemented with a short movie on some aspect of public health and followed by the customary informal discussion.

These informal gatherings and the free discussions that followed were of great value in helping the sanitarian to get personally acquainted with many people and facilitated release of the typical reserve of rural mid-westerners.

Requests for participation in these rural meetings soon overburdened the rural sanitarian, and it became necessary to obtain assistance from other members of the staff, notably the public health educator and public health nurses. Many requests for speaking engagements and technical services were received through the county extension agent. The county agent contributed as much as, or more than, any other individual to the introduction of health services among the rural populace. He contributed further to the program by donating the first set of septic tank forms.

By November 1947 we were getting calls from all over the county for technical assistance in planning the layout of septic tank systems and for advice on how to improve private water supplies.

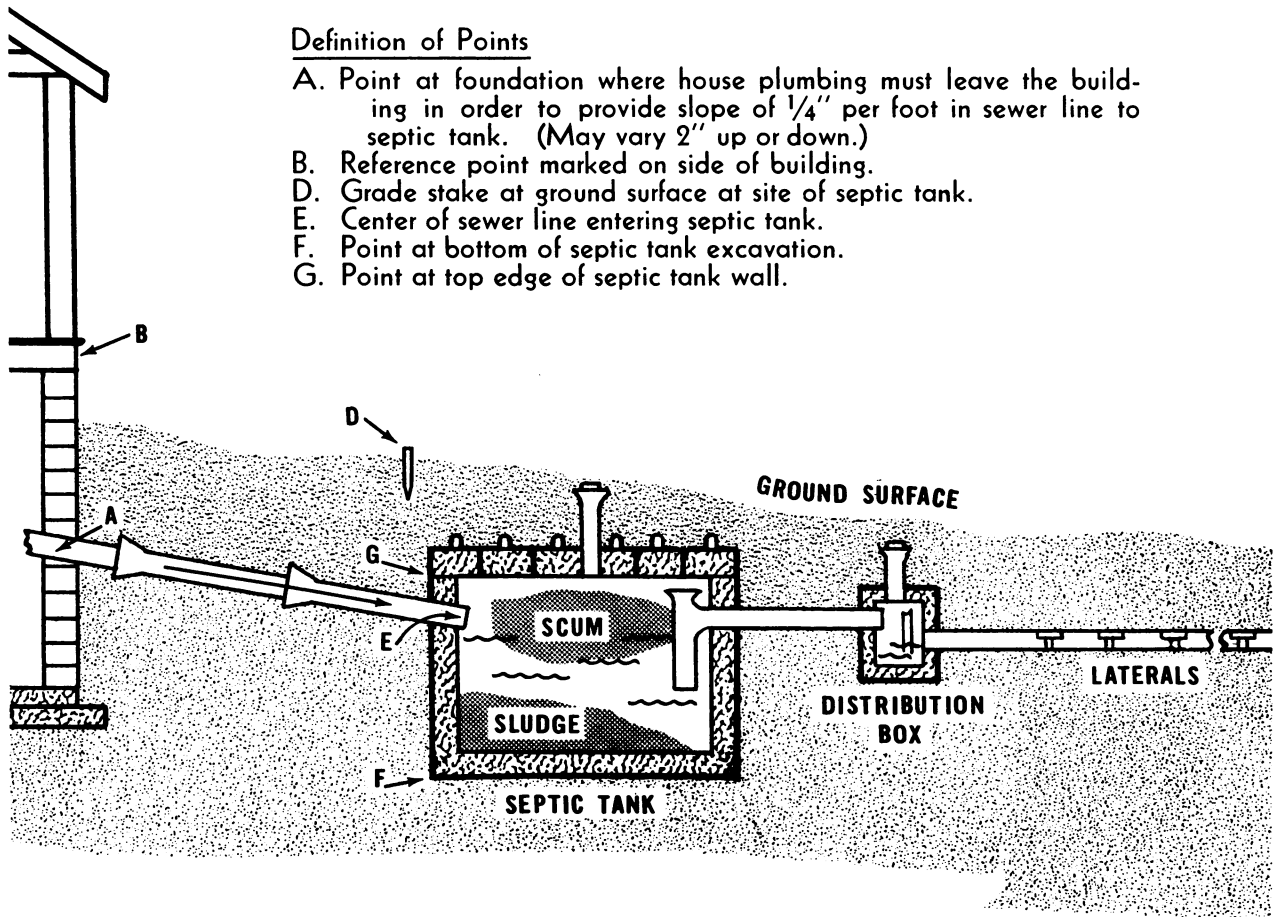
Septic Tank Installations

The demand for septic tank installations made it necessary to build two more sets of forms. We built one set and induced a local lumber company to build a set. For each use of the forms, we charged a rental fee of \$5.00 to cover maintenance and replacement of forms.

Each request for assistance was handled approximately as follows:

1. A date was set for the sanitarian to visit the home, lay out the system, and explain to the farmer what materials he needed to make the installation.
2. On the day the ready-mixed concrete was to be delivered for the tank and distribution box, the sanitarian was there several hours ahead of delivery time to make a final check on the setting of the forms, construction aids, and other details. The sanitarian on these occasions was not dressed to attend a wedding. I mention dress-

Figure 1. Septic tank work sheet.



Definition of Points

- A. Point at foundation where house plumbing must leave the building in order to provide slope of $\frac{1}{4}$ " per foot in sewer line to septic tank. (May vary 2" up or down.)
- B. Reference point marked on side of building.
- D. Grade stake at ground surface at site of septic tank.
- E. Center of sewer line entering septic tank.
- F. Point at bottom of septic tank excavation.
- G. Point at top edge of septic tank wall.

NOTE TO PLUMBER:

The house sewer pipe must leave the building at point A (2" + or -) which is _____ ft., _____ in. below point B marked on outside of house. The center of discharge end of sewer to septic tank (E) must be _____ ft., _____ in. below grade stake D (2" + or -).

NOTE TO SEPTIC TANK CONTRACTOR:

The tank is to be located _____ ft. from dwelling.
 The hole for septic tank must be dug to a depth (D-F) of _____ ft., _____ in.
 The top edge of form (G) must be _____ ft., _____ in. below grade stake D.

NAME _____ PHONE _____

ADDRESS _____ OWNER _____

REMARKS:

LINCOLN CITY-LANCASTER COUNTY
 DEPARTMENT OF HEALTH

DATE _____

Sanitarian _____

Form S-600, Sept. 53.

ing appropriately as much because of the unheralded public relations significance as provision against construction errors. The sanitarian usually remained at the site until the concrete was in place.

In planning the installation, the sanitarian chose the location for the septic tank, distribution box, and disposal field. By use of an inexpensive surveyor's level (\$54) he established a profile for the entire system. After establishing the profile, he filled out in duplicate a septic tank work sheet (fig. 1). One copy was given to the farmer and the other was placed in the office files for possible future reference.

Many modifications of the features shown in figure 1 were used, but, generally, they have been installed with a house sewer slope of $\frac{1}{4}$ inch per foot, free discharge into the tank, no baffles, 3-inch drop in flow-line between tank inlet and outlet, T-connection on effluent line, 500-gallon concrete tank with sectional cover slabs, observation ports in septic tank cover and distribution box cover, depth of liquid in septic tank of 4 feet, distribution box provided with baffle and several standby discharge openings (plugged), and 3 to 6 separate tile lines for disposal field.

One noteworthy modification of the tile field used occasionally is an installation we have called an "under-drain system." It consists of two levels of drain tile separated by 24 inches of gravel, the lower-level tile discharging into a stream or ravine ultimately seeking disposal by way of natural surface drainage. The idea is not new, but our experience indicates that this is a very satisfactory method in cases where, due to soil density, ground water, or space limitations, conditions do not favor the standard tile system.

The health department has installed approximately 200 concrete septic tanks with its forms and has supervised at least another 100 systems using poured-in-place concrete, precast concrete, tile, or metal septic tanks. Many of the systems have been revisited to see how well they work and to check on certain technical details.

During a check of several systems in January 1950 (2 years following installation), tanks that had little or no protective earth covering were particularly noted. Although the winter temperature had averaged 18° F. for more than a

month, the temperature of sewage in tanks with concrete cover slabs exposed, averaged 41° F. A distribution box with only a loose piece of canvas as a temporary cover showed a liquid temperature of 38° F.

Another significant observation was the relatively larger volume of scum than is indicated in the literature on septic tank operation. In most installations the depth of scum was equal to sludge depth, and in some the scum depth exceeded sludge depth. Probably, the primary contributing factor is the higher percentage of animal fats and greases that the farm home discharges in its sewage, and to this extent, at least, domestic farmstead sewage is different from urban sewage.

In all of the installations, the influent sewer pipe terminates approximately 1 inch beyond the inside face of the septic tank wall and discharges the incoming sewage by free fall. In spite of the extensive buildup of scum, in no case was any obstruction to the incoming sewage observed.

From these observations, the sanitarian has concluded that the following principles of septic tank construction in this area are sound.

1. With a minimum of earth covering, there is no reason to fear freezing in septic tanks, distribution boxes, or tile fields.
2. More consideration should be given to sludge storage capacity in tanks serving rural homes; any baffling that would restrict sludge storage capacity is considered detrimental.
3. Free-falling influents are totally satisfactory operationally, simple to construct, less expensive, and facilitate maintenance of the house sewer.

Peeking into the digestion chamber and bowels of an operating septic tank system may lack esthetic appeal even for conscientious sanitarians, but these explorations were of great value in reinforcing junior sanitarians' confidence in the accepted principles of septic tank sewage disposal systems.

Private Water Supplies

Requests for help in improving private water supplies throughout the county paralleled requests for aid in installing septic tanks. In private water supply improvements, above-

ground installations using some of the established principles of good well construction were stressed, and many improvisations were used.

Although Lancaster County does not have all types of surface geological formations influencing problems in well construction, there are enough of them to tax the sanitarian's inventiveness. One of the most unique problems is the scattering of underlying salt beds. To avoid these salt water horizons, we often called on the State geologist to help locate new wells. The source of ground water in Lancaster County is, for the most part, obtained from the mantle-rock of unconsolidated glacial drift. The salt water horizons giving trouble in relatively shallow private wells generally occur along the valleys of Salt Creek and its main tributaries. Salt Creek, running diagonally across Lancaster County from southwest to northeast, is the major stream in the county. Also, in some areas of the county there are pockets of impervious shales and clays, yielding their entrapped water with extreme reluctance.

Due to these geological restrictions and the cost of drilling new wells, the greatest challenge was to rehabilitate existing wells. Except in wells requiring only the elimination of well pits, most of the rehabilitation work dealt with tile-cased and dug wells. With few exceptions these wells were altered by replacing the existing upper 10 feet of tile casing or well wall with 4- or 6-inch diameter steel well casing.

The program of improving farm water supplies was on a voluntary or promotional basis. Consequently, there were no inhibiting restrictive regulations in making these improvements. In private wells, there is at least as much individuality as with human fingerprints, and the great variety of unorthodox but extremely practical techniques a resourceful sanitarian can use in improving farm water supplies is remarkable. The sanitarian has used so many old cultivator wheels, windmill sway-bracing, hog fencing, and the like, in rural sanitation work that he has difficulty interpreting the neat drawings normally attached to approved standards and regulations.

Another complicating factor in the private well improvement program was the occasional occurrence of excessive nitrate nitrogen

($\text{NO}_3\text{-N}_2$) in wells. Several cases of infant cyanosis (methemoglobinemia) were reported, and investigation revealed that high nitrate nitrogen in private well water supplies was the causative agent. A complete analysis of this problem would constitute a separate report, but the following comments are considered sufficient as a summary here.

In a group of 30 wells showing nitrate nitrogen concentrations in excess of 10 p.p.m., ranging from 10 to 108 p.p.m., construction alterations to prevent entrance of surface contamination into the wells have effectively reduced the objectionable nitrate nitrogen. Although numerous articles on the subject suggest that nitrate nitrogen is, in some cases, indigenous to a particular aquifer, our experience in Lancaster County strongly indicates that high nitrate nitrogen in well water is due to either a direct short circuiting of surface contamination into the well, or a recent indirect zonal contamination of the aquifer. Partial chemical analyses on investigated private water supplies have become somewhat routine along with the sampling for bacteriological analyses. This activity of the program is considered a good example of teamwork between the public health nurse, the health officer, and the sanitarian.

Local well drillers are, of course, an indispensable part of the well improvement program. Well drilling is characteristically an inherited craftsmanship, and unfortunately some of the old well drilling practices are not in harmony with present day standards of sanitation. It requires more than a little tact and perseverance to convert the well driller to these new ideas; to question his methods is tantamount to insulting his grandfather. In spite of these inherent characteristics, it is essential to indoctrinate the local well drillers with good sanitary practices. If this is properly accomplished, sanitarians will soon discover many new wells of good construction on which they were not even consulted.

Town Water Supplies

When the rural sanitation program was started, only one of the four town water supply systems was an approved above-ground instal-

lation. All pits have now been eliminated and in other respects altered to comply with State health department regulations.

These improvements were accomplished by a combination of techniques—repeated visits with town officials, attendance at council meetings, insistence on frequent sampling and analyses of their supplies. Also, we were opportunists. In one town, complaints of tastes and odors from residents necessitated major repairs to an oil-lubricated vertical turbine pump, and the town officials were convinced that other improvements might just as well be made at the same time. In another town, a spring flood gave us an assist. While muddy flood waters were still knee deep in the town pump house, the sanitarian invited the town water commissioner to wade out with us to see how things looked. It wasn't good. A series of samples showing evidence of contamination helped us on the third well.

In addition to improving existing town wells, three other towns have been induced to construct water supply systems. As in the case of town well improvements, these new water supply systems were the culmination of executive and public meetings with town boards reinforced with survey data on contaminated private wells and the mingling of private sewage disposal systems with private wells. These three new town systems are of the same basic design: 6-inch steel cased well, vertical turbine pump, pressure tank—all housed above ground in a neatly constructed pump house (fig. 2). They have a cast iron distribution system with fire hydrants. The average population of these towns is 170 people.

Rural Food Establishments

At the time of meeting with town boards to discuss water supplies, the sanitarian also requested permission to inspect local taverns and cafes. It was considered essential to contact town officials before entering the eating and drinking establishments. With the exception of taverns, our program of food establishment sanitation has not been on an enforcement basis. By resolution of the city-county board of health, the same general sanitation regulations of the Lincoln food ordinance, patterned after the

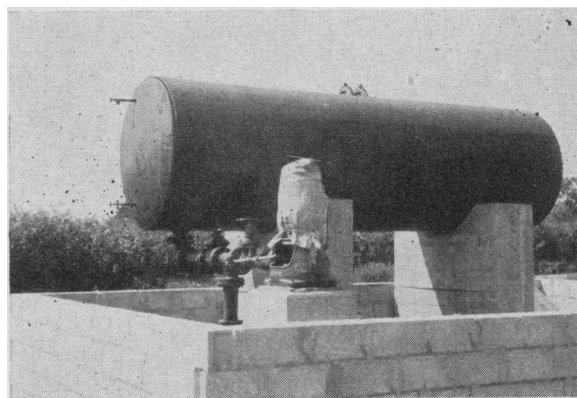


Figure 2. New town well prior to construction of pump house.

Public Health Service Ordinance and Code, are to apply to food and drink establishments elsewhere in the county. On rare occasions, the health department has appealed to the town boards to help in getting corrective action.

Taverns are issued licenses by the State liquor commission through the county commissioners of the respective counties. We have a working agreement with our county commissioners whereby no license is approved until they have received a satisfactory sanitation report from our department. This has been very successful in gaining improved sanitation in these places, and there are seldom any difficulties with the operators.

Other Activities

There is opportunity to supply numerous other services in a rural sanitation program, some by request and others by promotion. As the services of the department became known throughout the county, we received many calls in the nature of nuisance complaints. Several spring floods afforded us the opportunity to give emergency service during the floods, and following floods we conducted spraying operations in towns as fly and mosquito control measures. We always made a special effort to be conspicuously present (sincerely) in all areas affected by the floods, even at the expense of being up at all hours of the night. Any town isolated by flood waters was contacted by phone to show our concern for the town well or private water supplies. The county commissioners purchased

a power sprayer for our use in spraying operations in the county. We have conducted town surveys on private sewage disposal facilities and in this way have induced incorporated towns to adopt more comprehensive sanitary codes.

In retrospect it seems that there are almost limitless opportunities to give worthwhile services in a rural sanitation program.

Summary

It is proper and requisite that local health services be expanded to include rural sanitation activities whenever local interest is favorable. Based on experiences in Lancaster County, Nebraska, the following generalized comments are submitted as possible guides in the development of rural sanitation programs in other areas.

1. Before launching a rural sanitation program, a careful study should be made of the sanitation problems, local prejudices, personalities, and attitudes. Keep in mind that it may not always be advisable to assault the problems of highest public health priority.

2. A rural school sanitation program is a convenient and effective way of introducing the rural sanitation program to the rural community. It results in a prompt demonstration of services, uniformly distributed over the area,

and has a better than even chance of a warm reception.

3. Regular and periodic visits with key officials (county commissioners, superintendent of schools, town boards, county extension agent) is an essential rule of conduct.

4. Re-indoctrination of local well drillers is essential to the extension of properly protected private water supplies.

5. Installing properly constructed septic tank sewage disposal systems is the most demanding of all activities of the sanitarian's time and energy. Procedures for properly installing these systems should be streamlined as rapidly as possible; local contractors should be informed of the essential specifications and induced to do the work without direct supervision by the sanitarian.

6. To be successful, the rural sanitarian must like evening meetings with rural people. He must be friendly, sincere, and patient.

I am convinced that skillful application of the principles outlined are as essential to a successful rural sanitation program as technical knowledge of the sanitary sciences. Conducting a rural sanitation program is a rewarding and satisfying experience; it has no equal as a training ground for sanitarians, and no other activity in sanitation affords such an opportunity for the exercise of diversified talents.

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PHS Exhibits

Diagnostic Techniques

Three exhibits—"Breath Sounds on Tape," "Heart Sounds on Tape," and "Screening for Diabetes"—specially designed for teaching devices and refresher courses may be borrowed from the Public Health Service.

Breath Sounds on Tape

Tape recordings of normal and abnormal chest sounds prepared by Dr. William B. Walsh of the Georgetown University Medical Center are synchronized with illuminated chest films in a 4½-minute cycle. The continuous tape may be heard through a bank of stethoscopic earphones or from a loud speaker.

Breath sounds on tape was exhibited at the 1954 scientific show of the American Medical Association in San Francisco.

The exhibit weighs 1,300 pounds and requires a booth 14 by 20 feet.

Heart Sounds on Tape

Recordings of heart sounds, prepared under the general direction of



Dr. W. Proctor Harvey of the Georgetown Medical Center, have been used by the Public Health Service as an exhibit.

The exhibit with high-fidelity sound equipment offers a 5-minute sample of heart sounds with explanatory comment. These sounds may be heard with head phones or a loud speaker.

A full set of teaching tapes, which require about 4½ hours for the com-

plete run, may be borrowed, together with the special playback equipment.

The exhibit weighs 1,400 pounds and requires a booth 14 by 20 feet.

Screening for Diabetes

An exhibit featuring a continuous three-dimension motion picture, in color and with narration, has been produced by the Public Health Service to demonstrate the Wilkerson-Heftmann method of blood screening for diabetes.

This true glucose screening test can be performed in the physician's office in about 5 minutes at a cost of about 15 cents.

Although the exhibit (including the film) will not be distributed generally, it is available for showing at national and State medical meetings.

A booth 10 feet deep and 20 feet wide is required for the showing. The exhibit weighs 681 pounds.

For information about these exhibits, write to the Division of Special Health Services, Public Health Service, Department of Health, Education, and Welfare, Washington 25, D. C.

